

Logic QUIZ

1. Three propositions p , q and r are defined as follows:

p : the water is cold. q : the water is boiling. r : the water is warm.

- (a) Write one sentence, in words, for the following logic statement:

$$(\neg p \wedge \neg q) \Rightarrow r$$

- (b) Write the following sentence as a logic statement using symbols only.

"The water is cold if and only if it is neither boiling nor warm"

(Total 4 marks)

2. (a) Copy and complete the truth table below.

p	q	r	$p \Rightarrow q$	$q \Rightarrow r$	$\neg r$	$(p \Rightarrow q) \wedge (q \Rightarrow r) \wedge \neg r$	$\neg p$	$[(p \Rightarrow q) \wedge (q \Rightarrow r) \wedge \neg r] \Rightarrow \neg p$
T	T	T						T
T	T	F						T
T	F	T						T
T	F	F						T
F	T	T						T
F	T	F						T
F	F	T						T
F	F	F						T

(5)

- (b) Explain the significance of the truth table above.

(2)

(Total 7 marks)

3. Consider the statement "*If a figure is a square, then it is a rhombus*".

- (a) For this statement, write in words

- (i) its converse;
- (ii) its inverse;
- (iii) its contrapositive.

- (b) Only one of the statements in part(a) is true. Which one is it?

(Total 8 marks)

4. Let p and q be the statements:

p : Sarah eats lots of carrots.

q : Sarah can see well in the dark.

Write the following statements in words.

(a) $p \Rightarrow q$.

(b) $\neg p \wedge q$.

- (c) Write the following statement in symbolic form.

If Sarah cannot see well in the dark, then she does not eat lots of carrots.

- (d) Is the statement in part (c) the *inverse*, the *converse* or the *contrapositive* of the statement in part (a)?

(Total 8 marks)

5. (a) Solve $2x + 3 = 5$.

- (b) Consider the logic statements.

$$p: 2x + 3 = 5 \quad q: x^2 = x$$

The compound proposition $2x + 3 = 5 \Rightarrow x^2 = x$ is given.
Is this compound proposition true?

- (c) Write down the converse of this compound proposition.
(d) Give an example to show that the converse is false.

(Total 8 marks)

6. Consider the following statements:

p : Good mathematics students go to good universities

q : Good music students are good mathematics students

r : Students who go to good universities get good jobs

- (a) From these statements, write two **valid** conclusions.

- (b) Write in words each of the following

(i) $\neg q$;

(ii) $p \wedge r$.

(Total 4 marks)

7. If each of the following compound propositions is true, what conclusions can be made?

- (a) $x < 7$ or $x \geq 3$, and $x \neq 7$
- (b) $p = 3$ if and only if $q = 5$, and if $q \neq 5$ then $r \neq 12$.

(Total 4 marks)

8. (a) The following truth table contains two entries which are incorrect, one in column three and one in column four. Circle the two incorrect entries.
- (b) Fill in the two missing values in column five.
- (c) Which **one** of the following words could you use to describe the statement represented by the values in the last column (number 6)?
- (i) converse
- (ii) tautology
- (iii) inverse
- (iv) contradiction
- (v) contrapositive

1	2	3	4	5	6
p	q	$p \wedge q$	$\neg p$	$p \vee q$	$(p \vee q) \wedge (\neg p \wedge \neg q)$
T	T	T	F	T	F
T	F	F	F		F
F	T	F	T	T	F
F	F	T	F		F

(Total 8 marks)

9. Two logic propositions are given

p : Dany goes to the cinema
 q : Dany studies for the test

- (a) Write in words the proposition
- $p \vee q$.
- (b) Given the statement s : "If Dany goes to the cinema then Dany doesn't study for the test".
- (i) Write s in symbolic form.
- (ii) Write in symbolic form the contrapositive of part (b)(i).

(Total 6 marks)

10. Let p and q be the statements

p : you watch the music TV channel

q : you like music

(a) Consider the following logic statement.

If you watch the music TV channel then you like music.

(i) Write down in words the inverse of the statement.

(ii) Write down in words the converse of the statement.

(4)

(b) Construct truth tables for the following statements:

(i) $p \Rightarrow q$.

(ii) $\neg p \Rightarrow \neg q$.

(iii) $p \vee \neg q$.

(iv) $\neg p \wedge q$.

(4)

(c) Which of the statements in part (b) are logically equivalent?

(1)

(Total 9 marks)